INTERACTIVE VIDEO, TABLETS AND SELF-PACED LEARNING IN THE CLASSROOM: PRESERVICE TEACHERS PERCEPTIONS

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ABSTRACT

In recent years, a lot of focus has been given to the study of interactive video. However, interactive video has not been examined as a tool for self-directed learning in the classroom and has not been exploited together with tablets. This study tries to assess the value of an e-learning environment which is based primarily on interactive learning video and which is supposed to enable self-paced learning in the classroom with the use of tablets. A study with 48 undergraduate students attending the third year of their studies in a Pedagogical Faculty was conducted. Students got connected to the online environment and without any guidance, they were asked to follow a learning path concerning thermal heat transfer for 45 minutes. Data collection came through a questionnaire, researchers' observation and focus groups and the participants were asked to express their views both as learners and as future teachers. Undergraduate students were very positive both in regards to the learning efficiency of the environment and the experienced enjoyment. The students assessed the interactive video as interesting, original, unexpected and innovative and were enthusiastic with the new pedagogical approach. Since the new approach requires students to work in teams and each team should be autonomous, they characterized the approach as a truly student-centered and innovative.

KEYWORDS

Interactive Video, Mobile Devices, Self-Paced Learning, Self-Regulated Learning

1. INTRODUCTION

Videos are one of the most frequently used media in classroom settings. Several studies have shown that video presents knowledge in an attractive and consistent manner, it can improve the teaching methods and increase the learning outcome. However, it is well-reported that linear video may also lead to superficial learning and unsatisfactory viability of the learning effect, a phenomenon which is called "couch-potato-attitude"(Ertelt, Renkl & Spada, 2006). One of the biggest drawbacks of the video is that the students are unable to fully interact with the medium (Laurillard, 2012)and several researchers support that video will only reach its full potential in well-conceptualized learning environments (Krammer et al.2006). Nowadays, the levels and types of interactivity in video-based learning environments are constantly evolving. Interactive features can be used for various reasons such as testing the learners' knowledge at specific points in the video timeline, making learners' navigation more efficient with internal video links and enriching video viewing experience by dynamically aggregating content from the web and content generated by the educator inside the video (Kleftodimos & Evangelidis, 2016).

Interactive video has not been examined as a tool for self-directed learning in the classroom. Moreover, interactive video has not been exploited and explored together with tablets. In this study, we present the attitudes of preservice teachers towards a learning model that tries to provoke self-directed learning in the classroom by utilizing interactive video and tablets.

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2. THEORETICAL BACKROUND

2.1 Learning through Interactive Video

Most studies adopt a common definition about the interactive video: "A non-linear, digital video technology that allows students to have their full attention to educational materials and to review each section of video as many times as they wish" (Dimou et al., 2009; Weston & Barker, 2001). Zhang et al. (2006), have indicated better learning results when using non-linear video in opposition to linear video. Many new ways for interacting with video content have been proposed in the last decade. In a recent review, Schoeffmann et al. (2015) classifies video interaction methods in the following categories: capabilities to annotate, tag or label segments or objects in a video, capabilities to interact together with other users in a synchronized way, to interact with individual objects in the video, to support navigation inside a video, to filter video content and to generate summarized view of the content.

Wouters et al. (2007) support that there are two levels of learning interactivity: The first level is the functional interactivity on students actions (e.g. feedback after the student's answer.) The second level concerns cognitive interactivity which involves calls for actions that trigger cognitive and meta cognitive processes. For example, a challenge to predict what will happen next in the video, provokes students to select and organize information and incorporate it into their pre-existing knowledge. These interactive behaviors seem to have significant learning results (Wouters et al., 2007). A crucial element of the interactive video is that it can become a platform for self-regulating learning environments (Chen, 2012; Delen, 2014; Hartsell& Yuen, 2006). The possibility of controlling the individual speed, the offering of links which help avoiding cognitive overload (Chen, 2012), the possibility to seek or overtake a specific portion of the video and the ability to watch a specific portion again if needed (Zhang et al., 2006) provides a useful self-regulated instructional context where reduced levels of embarrassment or anxiety allow learners to be comfortable enough to learn new content (Pendell et al. 2013).

2.2 Self-Paced Learning with Tablets in the Classroom

Nowadays, there is a great interest on the "flipped classroom" in which typical lectures and homework elements of the courses are reversed. In this pedagogical model, students have to explore on their own the learning material while time in the classroom is about offering rich learning opportunities such as group learning activities, problem solving, case discussions or other active-learning methods (Rotellar& Cain, 2016). The teachers acquire a new role and continuously monitor and support their students, while providing them with feedback about their work. The rationale behind the flipped classroom approach is to increase students' engagement with content, increase and improve instructors' contact time with students, promote active learning activities, self-regulation and self-paced learning, and increase student accountability about their own learning process (Lai&Hwang, 2016).

An interesting question is whether the same goals can be pursued inside the classroom without the need for pre-class activities. Can the students exercise self-regulated behaviors, become responsible for their learning process, collaborate and do not receive direct teaching instruction in classroom? Tablets have shown that their characteristics match these aims, since studies have indicated that tablets can increase motivation (Kinash, Brand, & Mathew, 2012), foster student learning and performance (Fernández-López et al., 2013), promote personalized learning (McClanahan et al. 2012), encourage communication between teachers and stimulate face-to-face social interaction between children (Henderson &Yeow, 2012; Falloon, 2015), improve the quality of pedagogical support (Murray &Olcese, 2011) and increase self-directed learning (Fadel& Lemke, 2009). Direct real-time feedback to a student's actions moderates the level of distraction, since it allows them to flow on to the next task at hand, rather than idling in class and waiting for feedback (Henderson&Yeow, 2012). Tablets do provide substantive opportunities for self-regulated learning and educators who are open to new ways of teaching are seeing positive results. Such environments lead students from one step to another, but at the same time give them the opportunity to follow personal paths as they visit different learning units depending on their curiosity and the tasks at hand. Self-direction is a desirable skill that leads to optimal learning (Abar&Loken, 2010). Learners become more proactive, self-initiated and with higher levels of motivation for learning.

3. THE EDUCATIONAL ENVIRONMENT

This study is based on research on interactive video, the educational value of tablets and computer-supported self-paced learning. Two characteristics distinguish it:

A) Until today, tablets are exploited mainly as cognitive tools in the classroom. For example, they are used for practicing, testing, or game-based learning and usually as parts of a bigger instructional plan. Here, we will examine whether tablets can become tools for self-regulated learning in the classroom. In this pedagogical approach, students will be asked to follow a learning path by themselves and the instructor will hold a mentoring role and support students whenever they need to. Students sit in pairs in front of each learning device sharing 2 earphones. We selected the platform LearnWorlds (http://www.learnworlds.com) as the delivery environment since it is tablet friendly, and offers both the opportunity to create lesson paths and embed and edit interactive learning video in these paths. A learning path can be consisted of interactive videos, ebooks, informal testing, exams, sounds, external web pages, certifications etc. In the next picture, the learning environment is presented. At the left side, there is the learning path while in the right side the different learning units are delivered. In the specific figure, a video is interrupted with an in context question.

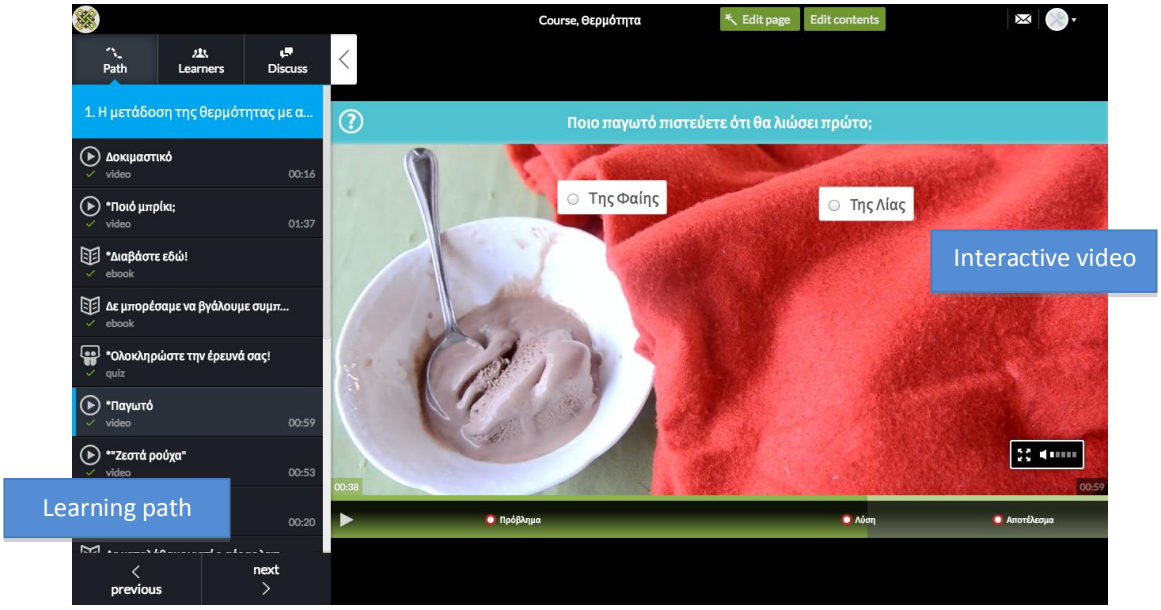

Figure 1. The Learning Environment

B) The learning path is mainly consisted of interactive learning video. The videos have been enriched with the following interactive elements:

- ***Pointers,*** which are used to control learners' attention and provoke them to think or discuss with their partners. Pointers reduce the cognitive load required for processing the video.
- ***Inductive questions***, which are used for practicing previous knowledge and helping students to interpret a hypothesis presented. These questions motivate students to take notes and monitor carefully the whole video in order to be able to answer the corresponding questions.
- ***Rhetoric questions***, which challenge students to predict what will happen next in the video. These types of questions, help students externalize their learning misconceptions, provoke their interest and also motivate them to be more concentrated in the video in order to validate by themselves their answers. Both inductive and rhetoric questions may provide immediate feedback or not, depending on the teacher's goals.
- ***Internal video links***, which enable students to navigate inside the video faster than clicking randomly on the video bar. Internal links can be presented either at specific time points over the video or can be embedded inside the video play bar and function as content anchors. That way, each video has an internal structure which is clearly visible and accessible for the students.

- ***External video links***, which are presented with labels over video at specific time points and aim to intrigue students to explore further the topic under examination with resources beyond the ones contained in the learning path.
- ***Inter-path links***, which guide students in different steps in the learning path. These links can be used either to help students remember issues forgotten or control the pace and proceed to content of special interest to them.

The learning content of the experimental environment concerned heat transfer and was designed for students of 5th and 6th grade. Content development tried to produce authentic learning experiences, take under consideration students learning misconceptions in thermal heat transfer and include video that were produced by the researchers and had children of the same age as actors. The environment also included remixes of related YouTube video enhanced with interaction elements, informal questionnaires with immediate feedback, tests with scores, short ebook texts, and plenty of links to useful resources. The researchers took under consideration several design principles concerning the development of educational videos (e.g. Mayer, 2005; Palaigeorgiou & Despotakis, 2010; Despotakis et al. 2007)

The research aims of this study are to evaluate preservice teachers' attitudes and views on the proposed educational setting and the learning environment. More specifically, we wanted to extract preservice teachers views on

- the expected learning outcomes and the educational value of the interactive video platform,
- the expected classroom dynamics regarding the concentration, the interest, the autonomy and the self-regulation of the learning pairs,
- the usability of the learning environment and the interactive video and learners' satisfaction.

4. METHOD

A study with 48 undergraduate students (34 females and 14 males) attending the third year of their studies in a Pedagogical Faculty was conducted. All participants had experience using tablets. The study was conducted in two sessions in order to have two groups close in size to the real classrooms. 23 students attended the first session and 25 the second one. Undergraduate students formed paired groups and became themselves the learners. The sessions were conducted through mobile devices and PCs (26 of the students used tablets and 22 PCs) in order to investigate whether the touch-based interface was less favorable in such an environment. Each session lasted 45 minutes. Students got connected to the online environment and without any guidance, they had to follow the specified learning path concerning thermal heat transfer. Two instructors were available to help them both with the technical requirements and the learning content. Also, each group had to complete a worksheet during the session.

Figure 2. Students Working Together with a Tablet

Data collection was actualized through a questionnaire, researchers' observation and focus groups. The questionnaire consisted of 12 6-point Likert questions and assessed students' satisfaction from the learning environment, students' perceived learning value of the environment and students' perceptions about the way self-paced learning evolved. The questionnaire was administered immediately after the end of each session.

The two researchers took notes about the learning ecology of the experiment and particularly the collaboration between the students. Focus groups lasted about 20 minutes for each session and were recorded, transcribed and analyzed thematically. Questions were focused on the classroom dynamics, learning efficiency, and platform usability (e.g. Would you be interested in teaching your students with a similar learning environment? Do you think this would work in a classroom of elementary school? Could this motivate students? How is this approach different from a more traditional instruction?)

5. RESULTS

5.1 Questionnaire Responses

Preservice teachers' responses are presented in Table 2.It is obvious that they were strongly positive both in regards to the satisfaction from the learning environment and its learning efficiency. Undergraduate students considered the environment easy, interesting and playful, and also supported that it will trigger primary school students' interest while it will also be appealing to them. It is quite interesting that most of the undergraduate students admitted that they had misconceptions about thermal heat transfer and that the learning environment helped them to clarify the phenomenon. The overwhelming majority of the undergraduates supported that during the 45 minutes sessions they developed their personal knowledge on the field and that provides evidence that the learning process was effective even for them.

The respondents were a little bit cautious regarding the prospect of managing a classroom with tablets. This kind of learning environments are unknown territories for the undergraduates both theoretically and practically and it is anticipated that some form of change management will be needed in order to persuade them to assimilate the new kinds of learning interactions. No statistical differences were identified between responses from learners that used the desktop environment and the tablets. The tablet condition was as usable, easy and enjoyable as the desktop environment.

Table 1. Students' Responses to the Questionnaire

Questions	Tablet		PC		Total	
	Average	SD	Average	SD	Average	SD
I am satisfied with the use of the online environment.	4.88	0.77	4.77	1.02	4.83	0.88
It was easy to use the environment.	5.12	0.95	5.36	0.9	5.23	0.93
The environment was boring.	1.85	0.83	1.9	1.15	1.88	0.98
Elementary students would learn in a playful way through this environment.	5.3	0.62	5.36	0.79	5.33	0.69
The educational environment helped me understand that some materials are more thermally conductive than others.	5.19	0.75	5.18	0.66	5.19	0.70
I can recall which materials are usually conductors and which are usually insulators.	5.23	0.71	4.55	1.06	4.92	0.94
I had the misconception that woolen clothes warm	4.07	1.16	4.23	1.63	4.15	1.38
I better understood how the air acts as an insulator	5.07	0.63	4.77	1.1	4.94	0.89
The environment can trigger students' interest.	5.27	0.96	5	1.02	5.15	0.99
It would be problematic to control the class when using mobile devices.	2.96	1.15	3.09	1.44	3.02	1.28
The sharing of the tablet by two people is problematic.	1.8	0.75	2.95	1.65	2.33	1.36
Such an environment has nothing to offer.	1.27	0.45	1.59	1	1.42	0.77

5.2 Focus Groups

5.2.1 Perceived Learning Value

Students claimed that the course content was authentic and original and addressed exceptionally well many misconceptions maintained even by adults. They stated that they had never thought about the case studies presented and that the primary school students would acquire useful knowledge for their daily life.

"I don't think we knew all of content, there were many new elements for us".

"The examples were really unusual. We've never thought of them".

"It was friendly and easy to use, it was very interesting and the content was derived from everyday life".

"We definitely clarified concepts".
"Children will easily understand the concepts despite their misconceptions".

5.2.2 Interactive Video

The students assessed the interactive video as interesting, original, unexpected and innovative. The interactive video exceeded the undergraduates' expectations as learning tools. Implicitly, students praised interactive video affordances for self-regulating learning:
"I did not expect the videos to be so interactive, we had options, we had to wait and decide -it was interesting".
"We haven't seen interactive video again-it's very interesting".
"We would definitely like to create video like that as teachers".
"Interactive video are much better from a text or from a simple video, because there is a lot of feedback".
"It think it could be used to diversify instruction because students replay the video if necessary or go back to watch another video if they want to or go to the next unit".
"Some go slowly, others go faster-each team can retain their own pace".
"It certainly helps to diversify instruction".

5.2.3 Pedagogical Approach

The majority of the students claimed that they cooperated productively with their peers and discussed the questions posed thoroughly. They considered advantageous the collaborative usage of the devices however they were not sure whether these advantages will also apply to primary school students:
"We always talked with our colleagues about what to do".
"We talked enough, we thought, we exchanged ideas, our opinions".
"And we exchanged views on physics and we learned things together we didn't know".
"Being in pairs was very helpful".
"It was better because we could talk".

The undergraduates were enthusiastic with the new pedagogical model and since they were working autonomously, they regarded it as a truly student-centered and innovative approach. They also enjoyed a lot the self-regulated learning but were cautious whether this level of autonomy could be applicable to the primary school students:
"It is learner-centered-perfect".
"Perfect teaching."
"One of the best features was that we were let completely alone to interact with tablets".
"There wasn't someone over my head telling me to do this, to do that".
"Creative, it develops children's imagination".
"Fascinating, interesting and easy, attractive, pleasant, innovative".
"Interactive and motivating for children, due to new technologies".

The students were very positive also about the other elements of the learning environment which were significant for improving the learning results:
"It was a very interesting instruction. It includes videos, dialogues and tests that could be used also in the evaluation of the lesson".
"Reflection quizzes gave us valuable feedback and helped us understand our mistakes".

5.2.4 Future Implementation in Elementary School

The overwhelming majority of students declared that they would definitely apply such a learning intervention in their classrooms. Students said that they would be interested to learn more about it, since it was enjoyable and provided autonomy to the students while letting the teacher to get a new and more productive role:
"We would use the platform, because it would be of much more interest to the students.
"Yes, students could easily find answers to their questions".
"If there were no problems with the network, we would certainly use it".
"It is difficult for children to reject it".

5.3 Researchers Observations

The classroom dynamics in both sessions exceeded the researchers' expectations. We were pleasantly surprised by the ease with which students became independent from the instructor and retained their own pace. Students throughout the sessions were fully dedicated as teams to the learning material, and each team followed its own path by revisiting activities and completing worksheets in their own way. The teams were impressively engaged with the learning environment and the learning content and it is was also unexpected that all the undergraduates would complete several times the tests and study repetitively the learning material in order to get the higher possible score in tests (while this was not even commented in anyway). Students worked excellently together, without any problems while sharing the devices. They discussed a lot and interacted a lot. Each question either in the video or in the tests, was a starting point for a constructive debate. The interactive elements of the video made them fully concentrated on the presented video while the variety of the video interactions (e.g. rhetoric questions or inductive questions) increased their interest. Students asked only for a few times the support of the researchers, and most of the times their inquiries were technical.

6. CONCLUSIONS AND FUTURE WORK

This study tries to answer whether students can show self-regulated behaviors, become responsible for their learning process, collaborate, do not receive direct teaching instruction in the classroom and concurrently learn. We have strong indications that the combination of a self-paced e-learning environment, together with interactive video and tablets may be able to achieve these objectives. Undergraduate students were very positive both as students and as future teachers about the prospects of this approach, and attributed it with advantages such as learning efficiency, learning effectiveness, students' enjoyment and better classroom dynamics.

It is important to note that the proposed approach is also easily accessible. It requires access to a self-paced learning platform, to an interactive video platform and tablets, while it can also be applied in the lab. The new stream of interactive video tools is easy to use and the interactivity features are built on top of common video services such as YouTube or Vimeo. In a matter of seconds a video can become interactive without the need for time-consuming editing processes. Titles, pointers, overlay images, links, examples, questions, interactive object etc. are all compiled dynamically and can be authored and changed by the instructor at any point. There is no research however, on how to design efficient learning interactive video, there are no guidelines on how to structure a simple video in order to add afterwards layers of interactivity.

Can this approach be applied to every learning domain? Thermal heat transfer is a field that requires conceptual change since it concerns intuitive concepts about the natural world and requires transforming the intuitive concepts into more scientific alternatives. Videos about daily life arguably are more attractive than videos in other fields while they also involve mental representations and not practical skills. Hence, the transferability of the approach has to be studied more thoroughly. There is always also the possibility that students' engagement comes from the novelty effect, which means that engagement would be high early on while the students are unfamiliar with the learning setting, but after gaining familiarity, the level of engagement will drop. More research is needed with students of primary schools and with a long-term view in order to validate whether this approach meets its initial promises.

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